

Patent Claims

1. A microcapsule, especially for immobilizing solids, liquids, cells, microorganisms and/or mixtures from these materials for use in chemistry, food technology
5 and/or pharmacy, comprising a preferably spherical core containing the material to be immobilized and preferably an envelope enclosing the same, characterized in that
the capsule is stable when stored in a concentrated medium and, upon the dilution of the same, is destroyed already under a small mechanical stress,
10 the material to be immobilized is completely enclosed by the matrix (the capsule core) ,
the capsule core may be surrounded by a multilayer envelope completely enclosing the same,
15 the envelope contains at least one layer covalently and/or electrostatically bonded to the adjacent one underneath and/or above the same,
20 at least one layer of the envelope is applied to the capsule core by coating with a solid,
at least one layer of the envelope is formed on the capsule core by a membrane-forming liquid,
25 at least one layer of the envelope is formed by both complexing and coating.
2. A microcapsule according to claim 1,
characterized in that
30 the substance forming the core matrix is a substance of which drops can be produced, from which preferably spherical particles can be formed by means of a precipitation through the influence of ions or a temperature gradient.

3. A microcapsule according to claim 1 or 2,
characterized in that
the substance surrounding the material to be immobilized in the interior of the
core matrix may be an oil or another liquid immiscible with the matrix substance
5 such as a hydrocarbon, a hydrocarbon mixture.
4. A microcapsule according to one of claims 1 to 3,
characterized in that
the material to be immobilized forms a suspension with a second substance
10 disposed in the interior of the capsule, which forms a phase boundary with the
matrix substance.
5. A microcapsule according to one of claims 1 to 4,
characterized in that
15 the material to be immobilized forms a liquid/liquid emulsion with a second
substance disposed in the interior of the capsule, which forms a phase
boundary with the matrix substance.
6. A microcapsule according to one of claims 1 to 5,
20 characterized in that
the core matrix or at least one phase in the capsule core contains a solid.
7. A microcapsule according to one of claims 1 to 6,
characterized in that
25 at least one phase in the capsule core contains a liquid.
8. A microcapsule according to one of claims 1 to 7,
characterized in that
at least one phase in the capsule core contains cells.
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9. A microcapsule according to one of claims 1 to 8,
characterized in that
at least one phase in the capsule core contains microorganisms.

10. A microcapsule according to one of claims 1 to 9,
characterized in that
the coating of the capsules is accomplished in a fluidized-bed process.
- 5 11. A microcapsule according to one of claims 1 to 10,
characterized in that
it can be dried without suffering significant losses of functionality.
- 10 12. A microcapsule according to one of claims 1 to 11,
characterized in that
the drying of the capsules is accomplished in a fluidized-bed process.
- 15 13. A microcapsule according to one of claims 1 to 12,
characterized in that
while its drying in a fluidized-bed process, a solid is additionally blown into the
column which forms a membrane on the capsule surface.
- 20 14. A microcapsule according to one of claims 1 to 13,
characterized in that
all materials from which it is formed may be food-approved.
- 25 15. A microcapsule according to one of claims 1 to 14, during the production of
which some, several or all of the following steps are performed, of which some
steps may also be repeated several times:
- dissolving or suspending the material to be encapsulated in a base material
 - producing drops of this base material suspension or solution
 - precipitating the drops
 - sealing the drops with the simultaneous precipitation by flowing round the
globules in a precipitation bath which also contains an ionic polymer solution
 - 30 in addition to the precipitating reagent
 - rinsing and suspending the globules formed by the precipitation in a
washing liquid

- flowing round the globules with a cationic or anionic polymer solution and forming a cationic or anionic charge on the surface of the sphere
- washing the globules with a washing liquid
- flowing round the globules with an anionic or cationic polymer solution and
- 5 - forming an ionic or cationic charge on the surface of the sphere
- rinsing and suspending the globules formed by the precipitation in a washing liquid
- drying the globules
- placing (suspending) the dried globules in a concentrated medium such as a
- 10 gel
- storing the globules in this concentrated medium over a certain period.

16. A microcapsule according to one of the preceding claims, characterized in that

15 the deliberate destruction of the capsule is achieved if complexing agents in the medium surrounding the capsule matrix extract ions from the same and destabilize the capsule.

17. A microcapsule, especially for immobilizing solids, liquids, cells, microorganisms and/or mixtures from these materials for use in chemistry, food technology and/or pharmacy, comprising a preferably spherical core containing the material to be immobilized and preferably an envelope enclosing the same, characterized in that

20 the capsule is stable when stored and contains at least one component resulting in a destruction of the capsule and release of the encapsulated material by a later change of the physical and/or chemical parameters of the surrounding medium,

25 the component contained in the capsule, resulting in a destruction of the capsule and release of the encapsulated material by a later change of the physical and/or chemical parameters of the surrounding medium, is an enzyme capable of breaking down specific substances of the capsule matrix and/or the capsule membrane,

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the component contained in the capsule, resulting in a destruction of the capsule and release of the encapsulated material by a later change of the physical and/or chemical parameters of the surrounding medium, is a substance that can be broken down by an enzyme contained in the capsule,

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the component contained in the capsule, resulting in a destruction of the capsule and release of the encapsulated material by a later change of the physical and/or chemical parameters of the surrounding medium, is a substance that can be precipitated in a reversible process by the influence of ions,

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the material to be immobilized is completely enclosed by the matrix (the capsule core),

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the capsule core may be surrounded by a multilayer envelope completely enclosing the same,

wherein the envelope contains at least one layer covalently and/or electrostatically bonded to the adjacent one underneath and/or above the same,

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at least one layer of the envelope is applied to the capsule core by coating with a solid,

at least one layer of the envelope is formed on the capsule core by a membrane-forming liquid, and/or

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at least one layer of the envelope is formed by both complexing and coating.

18. A microcapsule according to claim 17,
characterized in that

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the substance forming the core matrix is a substance of which drops can be produced, from which preferably spherical particles can be formed by means of a precipitation through the influence of ions or a temperature gradient.

19. A microcapsule according to claim 17 or 18,
characterized in that
the substance surrounding the material to be immobilized in the interior of the
core matrix may be an oil or another liquid immiscible with the matrix substance
5 such as a hydrocarbon, a hydrocarbon mixture.
20. A microcapsule according to one of claims 17 to 19,
characterized in that
the material to be immobilized forms a suspension with a second substance
10 disposed in the interior of the capsule, which forms a phase boundary with the
matrix substance.
21. A microcapsule according to one of claims 17 to 20,
characterized in that
15 the material to be immobilized forms a liquid/liquid emulsion with a second
substance disposed in the interior of the capsule, which forms a phase
boundary with the matrix substance.
22. A microcapsule according to one of claims 17 to 21,
20 characterized in that
the core matrix or at least one phase in the capsule core contains a solid.
23. A microcapsule according to one of claims 17 to 22,
characterized in that
25 at least one phase in the capsule core contains a liquid.
24. A microcapsule according to one of claims 17 to 23,
characterized in that
at least one phase in the capsule core contains cells.
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25. A microcapsule according to one of claims 17 to 24,
characterized in that
at least one phase in the capsule core contains microorganisms.

26. A microcapsule according to one of claims 17 to 25,
characterized in that
the coating of the capsules is accomplished in a fluidized-bed process.
- 5 27. A microcapsule according to one of claims 17 to 26,
characterized in that
it can be dried without suffering significant losses of functionality.
- 10 28. A microcapsule according to one of claims 17 to 27,
characterized in that
the drying of the capsules is accomplished in a fluidized-bed process.
- 15 29. A microcapsule according to one of claims 17 to 28,
characterized in that
while its drying in a fluidized-bed process, a solid is additionally blown into the
column which forms a membrane on the capsule surface.
- 20 30. A microcapsule according to one of claims 17 to 29,
characterized in that
all materials from which it is formed may be food-approved.
- 25 31. A microcapsule according to one of claims 17 to 30, during the production of
which some, several or all of the following steps are performed, of which some
steps may also be repeated several times:
- dissolving or suspending the material to be encapsulated in a base material
 - adding an enzyme capable of breaking down specific components of this
mixture and/or capsule coating
 - producing drops of this base material suspension or solution
 - precipitating the drops
 - 30 - sealing the drops with the simultaneous precipitation by flowing round the
globules in a precipitation bath which also contains an ionic polymer solution
in addition the precipitating reagent

- rinsing and suspending the globules formed by the precipitation in a washing liquid
- flowing round the globules with a cationic or anionic polymer solution and forming a cationic or anionic charge on the surface of the sphere
- 5 - washing the globules with a washing liquid
- flowing round the globules with an anionic or cationic polymer solution and forming an ionic or cationic charge on the surface of the sphere
- rinsing and suspending the globules formed by the precipitation in a washing liquid
- 10 - drying the globules
- placing (suspending) the dried globules in a concentrated medium such as a gel
- storing the globules in this concentrated medium over a certain period.